REMARKS

Claims 1-10 and 16 are pending for further examination. Claim 1 is currently amended to incorporate the subject matter of previously presented claims 11-13, which are now canceled with this amendment. Claim 16 also is currently amended.

Claim Rejections Under 35 U.S.C. § 103(a)

Claims 1-13 and 16 were rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over the Roberts et al. reference (U.S. Patent App. Pub. No. 2005/0112418) in view of the Ooma et al. reference (U.S. Patent App. Pub. No. 2005/0151954) and further in view of the Guthrie et al. patent (U.S. Patent No. 5,009,968). In view of the foregoing amendments and the following remarks, Applicant respectfully requests reconsideration and withdrawal of the claim rejections.

Independent claim 1 recites, among other things, a control apparatus for a fuel cell stack that includes a solid polymer electrolyte fuel cell stack having a stacked body formed by stacking fuel cell units together and a pair of end plates sandwiching the stacked body, electrical heaters disposed near the ends of the stacked body or the end plates, respectively, a water purging device, temperature sensors for measuring temperature values of the fuel cell units, and a control unit which controls the power generation operation in the solid polymer electrolyte fuel cell stack.

The control unit is adapted to: operate the electrical heaters and the water purging device "when a power generation stop command...is output" in order to maintain a uniform temperature and uniform relative humidity across the fuel cell units. The control unit also is adapted to control the electrical heaters depending on the temperature values of the fuel cell units measured by the temperature sensors, in which controlling the electrical heaters is "based on a difference" between a first temperature value of at least one of the fuel cell units disposed in the middle of the fuel cell stack and a second temperature value of at least one of the fuel cell units disposed at the ends of the fuel cell stack. In contrast, none of the cited references, alone or in combination, discloses or renders obvious the subject matter of pending claim 1.

The Roberts et al. reference discloses a fuel cell electric power generation system that includes a fuel cell stack 210 (*see* FIG. 3). The Roberts et al. reference also discloses a method of expediting the warming of a fuel cell stack to a desired operating temperature range when the fuel cell stack is started (*see* ¶ [0036]). The method includes heating the fuel cell using an externally powered heater and allowing coolant to flow to the fuel cell stack only after the operating temperature of the stack has exceeded a predetermined temperature threshold (*see* ¶¶ [0038], [0048]).

The Roberts et al. reference fails, however, to disclose controlling electrical heaters "based on a difference" between a first temperature value of at least one of the fuel cell units disposed in the middle of a fuel cell stack and a second temperature value of at least one fuel cell unit disposed at an end of the fuel cell stack, as recited in claim 1. Although the Roberts et al. reference discloses measuring an operating temperature of the fuel cell stack 210 using a temperature sensor at one or more locations within the stack 210 and heating the fuel cell with an externally powered heater, it fails to disclose that the heater is controlled "based on a difference" between a first temperature value of a fuel cell unit in the middle of the stack 210 and a second temperature value of a fuel cell unit at the end of the stack 210. Instead, the Roberts et al. reference merely discloses that temperature measurements are used to "provide or infer a representative or approximate value for the stack operating temperature" (*see* ¶ [0031]). There is no disclosure that the heater is controlled based on those temperature measurements, much less that the heater is based on a difference between a temperature value of a fuel cell unit in the middle of the stack 210 and a temperature value of a fuel cell unit at the end of the stack 210. Nor does the Roberts et al. reference render the subject matter of claim 1 obvious. In particular, the Roberts et al. reference fails to disclose or support any reason to modify the fuel cell stack 210 such that it would include heaters which are controlled based on a difference between a first temperature value and a second temperature value.

The Ooma et al. reference, which the Office relies on for maintaining a fuel cell at a uniform temperature, discloses a polymer electrolyte fuel cell stack that includes multiple unit cell components 7, in which each unit cell component 7 has a membrane electrode assembly 23,

a separator 5A and a water supply means (*see* FIG. 1 and ¶ [0038]). On one plate surface, the separator 5A includes multiple fuel gas flow paths 11 for supplying a fuel gas. On the other plate surface, the separator 5A includes multiple oxidizer gas flow paths 19 (*see* FIGS. 2A, 2B). The Ooma et al. reference fails, however, to disclose or render obvious the subject matter missing from the Roberts et al. reference. In particular, the Ooma et al. reference fails to disclose controlling electrical heaters "based on a difference" between a first temperature value of at least one of the fuel cell units disposed in the middle of a fuel cell stack and a second temperature value of at least one fuel cell unit disposed at an end of the fuel cell stack. Nor does the Ooma et al. reference support any reason to modify the device of the Roberts et al. reference so that it controls heaters "based on a difference" between a first temperature value of a fuel cell unit in the middle of a stack and a second temperature value of a fuel cell unit at the end of the fuel cell stack.

The Guthrie et al. patent, which the Office relies on for the claimed "control unit," discloses a molten carbonate fuel cell assembly 10 that operates at temperatures ranging from 590°C to 700°C (*see* col. 3, lines 8-10 and FIG. 1). The fuel cell assembly 10 includes a stack 12 of fuel cells 14. An electrical heater 24 is between the first 22 and second 26 portions of semi-rigid thermal insulation (*see* col. 3, lines 22-24). The Guthrie et al. patent fails, however, to disclose or render obvious the subject matter missing from the Roberts et al. reference. In particular, the Guthrie et al. patent fails to disclose controlling electrical heaters "based on a difference" between a first temperature value of at least one of the fuel cell units disposed in the middle of a fuel cell stack and a second temperature value of at least one fuel cell unit disposed at an end of the fuel cell stack, as recited in claim 1. Nor does the Guthrie et al. patent support any reason to modify the device of the Roberts et al. reference and the Ooma et al. reference so as to obtain the subject matter of pending claim 1.

For at least the foregoing reasons, claim 1 should be allowed.

Claim 1 should be allowed for the following additional reasons, as well.

None of the cited references discloses or renders obvious a control unit that is adapted to operate electrical heaters and a water purging device to maintain a uniform temperature and humidity across fuel cell units "when a power generation stop command for stopping power generation...is output," as recited by pending claim 1.

Although the Roberts et al. reference discloses a microcontroller to shut down a fuel cell stack, which the Office alleges corresponds to the claimed "control unit," the Roberts et al. reference fails to disclose that the microcontroller is adapted to operate electrical heaters to maintain the uniform temperature and humidity "when a power generation stop command for stopping power generation...is output." Instead, the Roberts et al. reference discloses that the heaters are operated "prior to commencing operation" of the fuel cell (*see*¶ [0048]). The Roberts et al. reference does not disclose or support any reason to operate electrical heaters when a power generation stop command is output.

In addition, although the Guthrie et al. patent discloses operating heaters, the heaters keep the end cells at the required operating temperatures (*see* col. 2, lines 41-44). There is no disclosure in the Guthrie et al. patent of operating the electric heaters to maintain a uniform temperature and humidity across the fuel cell units "when a power generation stop command for stopping power generation...is output." Nor does the Guthrie et al. patent support any reason to operate electrical heaters for maintaining a uniform temperature and humidity across fuel cell units when a power generation stop command is output.

The Ooma et al. reference also fails to disclose or render obvious maintaining an uniform temperature and humidity when a power generation stop command is output. Instead, the Ooma et al. reference discloses that the latent heat cooling system maintains the uniform temperature and humidifying conditions "regardless of an activation/stop operation" (*see* ¶ [0054]).

In rejecting the claims, the Office also alleges that it would have been obvious to "insert the teachings of Ooma et al. and Guthrie et al. into the teachings of Roberts et al. because Ooma et al., teach the advantages of providing a fuel cell stack having uniform temperature, uniform

humidity, and no surplus of water" (*see* Office action at p. 3). Applicant respectfully disagrees and submits that it would not have been obvious to combine the cited references in order to obtain a device having the claimed "uniform temperature and uniform humidity."

Although the Ooma et al. reference discloses a fuel cell stack in which each unit cell has uniform "humidifying conditions" and "uniform temperature distribution," such uniformity in humidity and temperature is achieved by flowing water through the fuel gas flow paths 11. As explained in the Ooma et al. reference, "using the latent heat cooling system, water supplied to the fuel gas flows evenly [and] each unit cell has uniform humidifying conditions, a uniform voltage distribution, and a uniform temperature distribution..." (*see* ¶ [0054]). Clearly, therefore, uniform humidity and temperature in the device of the Ooma et al. reference is not obtained by controlling electrical heaters, as recited in pending claim 1, but is instead made possible by flowing water through the fuel cell. Accordingly, it would not have been obvious to one of ordinary skill in the art to modify the heater of the Roberts et al. reference so that it could maintain a uniform temperature and relative humidity across a fuel cell stack. In particular, it would not have been clear how, in view of the cited references, one of ordinary skill in the art would have been able to modify a control unit so as to maintain uniform temperature and humidity across fuel cell units using one specific method (*i.e.*, through the control and activation of electrical heaters) based on a second completely different method (*i.e.*, by flowing water through fuel cell paths).

The Ooma et al. reference also fails to disclose or suggest maintaining a uniform temperature and relative humidity "across" multiple fuel cell units of the fuel cell stack, as further recited in pending claim 1. Although the Ooma et al. reference discloses operating with uniform humidifying and temperature conditions, such uniform conditions pertain to each individual unit cell (*see* ¶ [0054]). There is no disclosure or suggestion in the Ooma et al. reference of maintaining those uniform conditions "across" the fuel cell units.

The Office also alleges that the claimed limitation, "to maintain a uniform temperature and uniform relative humidity across the fuel cell units and to prevent a surplus of water in the

fuel cell units disposed near the end of the fuel cell stack," corresponds to "nonfunctional descriptive material" that is recorded on a computer-readable medium and therefore is not statutory (*see* Office action at p. 4).

This is incorrect. First, the foregoing limitation, as recited in claim 1, is not "nonfunctional." Nonfunctional descriptive material relates to, among other things, music, literary works, and a compilation or mere arrangement of data (*see* Manual of Patent Examining Procedure (MPEP) § 2106.01(II)). Functional descriptive material, on the other hand, can include data structures and computer programs which impart a functionality when employed as a computer component (*see* MPEP § 2106.01(I)). Clearly, maintaining a uniform temperature and humidity across fuel cells corresponds to a functional aspect of the claimed control unit.

Applicant further notes that functional claim features still serve as positive limitations capable of distinguishing the claimed subject matter from the cited art. Generally speaking, Applicants are given discretion to choose the manner in which to claim their inventions. As the MPEP states, "Applicant may use functional language, alternative expressions, negative limitations, or any style of expression or format of claim which makes clear the boundaries of the subject matter for which protection is sought" (*see* MPEP § 2173.01). The MPEP goes on to reiterate that "[t]here is nothing inherently wrong with defining some part of an invention in functional terms" and a "functional limitation must be evaluated and considered, just like any other limitation of the claim, for what it fairly conveys to a person of ordinary skill in the pertinent art in the context in which it is used" (*see* MPEP § 2173.05(g)).

Furthermore, the foregoing limitation is claimed as part of the control unit, which corresponds to statutory subject matter (*i.e.*, a machine). Accordingly, the claim should be considered statutory subject matter irrespective of whether the limitation is functional or nonfunctional.

At least for these additional reasons, claim 1 should be allowed. Claims 2-13 and 16 depend from claim 1 and should be allowed for at least the same reasons as claim 1.

It is believed that all of the pending claims have been addressed. However, the absence of a reply to a specific rejection, issue or comment does not signify agreement with or concession of that rejection, issue or comment. In addition, because the arguments made above may not be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed. Finally, nothing in this paper should be construed as an intent to concede any issue with regard to any claim, except as specifically stated in this paper, and the amendment of any claim does not necessarily signify concession of unpatentability of the claim prior to its amendment.

No fee is believed due. However, please apply any charges or credits to deposit account 06-1050.

Respectfully submitted,

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